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Mass Feeding of Salt and Phenothiazine to Breeding Ewes and Market Lambs

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J. H. Rietz and C. V. Wilson

PHENOTHIAZINE, a synthetic organic chemical, was first produced by an European chemist in 1885. Entomologists tested it experimentally as an insecticide for destroying mosquito larvae and for controlling the codling moth. Otherwise it remained a chemical curiosity until December 1938, when U. S. Department of Agriculture workers, after conducting a number of experiments with swine, reported that phenothiazine had value as an anthelmintic or worm medicine for swine.

During the 3-yr. period December 1938-1941, phenothiazine was further tested on farm animals and was found to have superior merit for ridding horses, cattle, sheep, and goats of certain gastro-intestinal roundworms.

Until 1941-42, phenothiazine was usually administered to animals either as a bolus or pellet, or in the form of a liquid drench. Mixtures of phenothiazine in feed were tried. After such trials, phenothiazine and salt mixed in various ratios was fed. The salt-phenothiazine mixture was tried on the assumption that the relatively heavy consumption of salt by sheep would result in their eating with the salt a sufficient amount of phenothiazine to reduce the worm population in the sheep and to destroy the ova or larvae in the droppings.

Results of the above tests were reported, and sheepmen were advised to administer a full dose of phenothiazine in the early spring. Later, throughout the pasture season, they were advised to offer salt-phenothiazine mixture, free choice, until freezing weather, when a full dose of phenothiazine was again to be administered.

Adoption of the phenothiazine-salt mixture for parasite control by sheepmen was remarkable. In 1939 only 900 pounds of phenothiazine were reported used, but by 1943, use as an anthelmintic in the United States had risen to nearly 3,000,000 lb.

A number of West Virginia sheepmen began the feeding of the salt-phenothiazine mixture to their flocks in the early 1940's. At once, numerous questions concerning its use for breeding ewes and their lambs were directed to the Experiment Station. In order that information secured under local conditions might be made available to West Virginia farmers, authorization was requested to maintain a flock of native grade ewes and their offspring, with access to a mixture of salt-phenothiazine as the only anthelmintic or treatment for control of gastro-intestinal parasites.

Authorization was granted and the investigations were started in the fall of 1943.

The objects of the subsequent trials were: to study the physical and physiological effects of *ad libitum* feeding of salt-phenothiazine mixture upon the ewes and their lambs, upon the parasites of the gastro-intestinal tract, and upon the number of parasite ova passed by the ewes and lambs.

PLAN OF THE EXPERIMENT

The 24 ewes selected in the fall of 1943 for this experiment were mostly from a flock previously used at this station for parasite control studies, where drenching at regular intervals was the method of control.

The pasture consisted of about 12 acres in which the flock was confined evenings, nights, and mornings. During the major portion of the daylight hours, the flock had access to a supplementary pasture of about 20 acres. During that part of the year when hay and grain was fed, the flock was confined in the 12-acre pasture.

The ewes were bred so that lambing occurred from the latter part of February to early April.

The lambs were weighed at birth and at regular intervals until they were marketed.

Fecal samples from both the ewes and the lambs were examined at regular intervals for parasite ova. The last fecal examination of the lambs was made from a sample taken from the rectum at the time of slaughter.

The lambs were weighed, graded, and marketed at weights of 75 to 80 lb.

The salt-phenothiazine mixture used in the first year of this experiment consisted of salt, 14 lb., and phenothiazine, 1 lb., or a salt-phenothiazine ratio of 14:1. After thorough mixing of salt and phenothiazine, the mixture was passed through a fine screen to break down all small lumps.

The box containing the salt-phenothiazine mixture was so placed in a shed that both the ewes and the lambs had access for feeding at will.

RESULTS

The Ewe Flock

Table 1 shows the ova count in the feces for each ewe at the beginning and end of each year of the mass feeding trials. From October 1943 to October 1944, the flock had access to the 14:1 salt-phenothiazine mixture. There was an average consumption of six-tenths pound of the mixture per month for each ewe and her lamb. This is approximately the normal salt consumption for sheep when they are allowed access to salt *ad libitum* (1), (6).

The parasite ova per gram of feces for ewes, in October 1943, averaged 354 and in October 1944 the average was 104 (columns 1 and 2, Table 1).

Table 1—Fecal Ova Count per Gram in Feces of Ewes at Beginning and End of Each Year of Feeding

Ewe no.	Salt 14: phenothiazine, 1		Salt 19: phenothiazine, 1		Salt 14: phenothiazine, 1		Salt 14: phenothiazine, 1	
	Oct. '43 Ova count	Oct. '44 Ova count	Oct. '44 Ova count	Sept. '45 Ova count	Sept. '45 Ova count	Sept. '46 Ova count	Sept. '46 Ova count	Aug. '47 Ova count
1	100	0	0	4300	4300	200	200	200
*14c	0	100	100	0	0	0	0	0
**14s	--	--	0	800	800	0	--	--
18	--	--	200	800	800	0	0	400
20	0	0	0	2600	--	--	--	--
34	1200	100	100	100	100	200	200	0
45	300	0	0	1000	1000	0	0	0
171	0	0	0	0	0	0	0	200
335	0	0	0	500	--	--	--	--
338	500	0	0	2400	2400	0	0	0
408	0	0	0	500	500	--	--	--
460	1300	300	300	500	500	0	0	0
464	0	500	500	100	--	--	--	--
502	400	200	200	7900	7900	100	100	100
537	0	0	0	2200	2200	0	0	0
567	0	0	0	4900	4900	0	0	100
568	700	200	200	2300	--	--	--	--
570	100	0	--	--	--	--	--	--
573	520	0	0	600	--	--	--	--
574	100	0	0	0	0	0	0	0
575	500	0	0	200	200	0	0	0
576	800	300	300	0	--	--	--	--
577	900	0	0	0	0	0	0	300
578	0	0	--	--	--	--	--	--
579	200	0	0	100	100	0	0	0
580	1300	800	--	--	--	--	--	--
925	--	--	--	--	900	0	0	0
926	--	--	--	--	4000	300	300	0
929	--	--	--	--	0	400	400	0
930	--	--	--	--	0	0	0	0
932	--	--	--	--	0	0	0	0
952	--	--	--	--	--	--	0	0
953	--	--	--	--	--	--	0	0
954	--	--	--	--	--	--	500	0
955	--	--	--	--	--	--	0	0
956	--	--	--	--	--	--	0	0
957	--	--	--	--	--	--	0	0
958	--	--	--	--	--	--	0	0
960	--	--	--	--	--	--	0	0
Av.	354	104	82	1382	1363	57	60	46

* 14c = No. 14 Corriedale.
** 14s = No. 14 Shropshire.

Replacements in the ewe flock became necessary in October 1944, at beginning of the second year's trials, after which the average ova count was 82 per gram of feces.

At this time the salt-phenothiazine ratio for the flock was changed from 14:1 to 19:1. By September 1945 the ova per gram of feces had increased from the average of 82 per gram to 1382 per gram (columns 3 and 4, Table 1). The condition of the flock at the end of 11 months of access to the 19:1 salt-phenothiazine mixture had declined slightly, and some of the ewes showed symptoms of parasitism.

In September 1945, additions to the ewe flock were necessary. After these additions the average ova count per gram of feces was 1363. The salt-phenothiazine ratio was also changed from 19:1 to the original proportion of 14:1. By September 1946 the ova count had decreased from 1363 to 57 ova per gram of feces (columns 5 and 6, Table 1).

Additions were made to the ewe flock in September 1946, after which the average ova count was 60 per gram of feces (column 7, Table 1). The salt-phenothiazine mixture of 14:1 was continued from September 1946 to September 1947 when the ova count was 46 per gram of feces (column 8, Table 1). At this time the experiment was terminated. The ewes were in excellent condition when sold.

The Lambs

Each crop of lambs had access for that current year to the same salt-phenothiazine mixture as the dams, from birth until slaughter. The lambs were creep-fed with a mixture of oats and corn from which the oats were gradually eliminated before the lambs were weaned and placed in the feed lot. In the feed lot the ration was whole corn and alfalfa hay.

Probably little of the salt-phenothiazine mixture was consumed by the young lambs, even though young lambs were seen sampling the mixture. This is indicated by the ova count in the feces. A higher ova count was found in July and August than at the earlier or later examinations. After this time the number of ova in the feces decreased, probably because of an increase in the consumption of the salt-phenothiazine mixture by the lambs (Table 2).

Table 3 shows the record of the growth, market data, ova count and autopsy findings of the 1944 crop of 24 lambs that had access to a 14:1 mixture of salt and phenothiazine. These lambs averaged 8 lb. at birth and averaged 64 lb. when placed in feed lot at 163 days of age. The crop when marketed at 198 days of age, averaged 78 lb. and returned a dressed carcass weight of 36.5 lb. The live and dressed grades averaged 2—* or low good.

Parasites were recovered from seven of the lambs at slaughter; however, none of them showed a heavy infestation.

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* 1 † = Prime; 1 and 1 — = Choice; 2 +, 2, and 2 — = Good grade.

Table 2—Record of Count of Ova per Gram in Feces in Four Crops of Lambs

1944	5/15	8/7	P-M*	1945	5/21	7/2	P-M	1946	5/5	7/15	P-M	1947	5/9	P-M
	14:1 salt-phenothiazine				19:1 salt-pheno.				14:1 salt-pheno.				14:1 salt-pheno.	
Lamb no.	Ova	Ova	Ova	Lamb no.	Ova	Ova	Ova	Lamb no.	Ova	Ova	Ova	Lamb no.	Ova	Ova
581	0	3520	1900	425	0	3200	0	933	0	2000	200	961	0	0
582	0	0	0	903	400	0	200	934	0	2000	3000	962	0	200
583	0	0	0	904	200	300	0	936	0	3100	4000	963	0	200
584	0	600	400	905	200	0	0	938	500	3900	2000	964	0	0
585	0	0	0	906	0	0	100	939	0	0	1200	965	0	600
586	0	1400	0	909	0	0	0	940	0	3200	1200	966	100	400
587	0	200	0	910	0	100	0	942	0	900	2200	967	300	700
588	500	400	0	913	600	500	3500	944	0	2300	1000	968	0	0
590	0	0	800	914	200	1200	2500	945	0	3500	2300	969	0	0
591	400	1900	0	915	0	700	5000	946	0	200	1600	970	0	0
592	0	0	0	916	0	0	0	948	0	800	2600	971	0	0
594	0	0	0	918	0	0	7000	949	0	900	2100	972	200	0
596	0	0	500	919	0	0	1700					973	200	0
412	0	0	200	920	500	200	300					974	0	0
413	0	0	0	921	0	400	0					978	400	200
414	0	0	0	922	0	0	100					980	0	100
415	0	1500	0	923	0	0	200					981	0	0
416	0	0	0	924	0	100	200					982	0	0
418	1200	0	700									984	0	0
420	0	0	400									985	0	0
421	0	0	0									986	0	200
422	0	200	600									987	0	300
423	200	800	100											
424	0	1200	0											
Av.	96	491	233		128	372	1155		42	1900	1950		55	160

*Post mortem.

Table 4 shows the record of the growth, market data, ova count, and autopsy findings of the 1945 crop of 18 lambs that had access to a 19:1 salt-phenothiazine mixture.

This group of lambs averaged 8.5 lb. at birth; nine of the lambs when placed in the feed lot at 157 days of age averaged 66 lb. On the day these lambs were placed in the feed lot, the other nine were marketed. This entire crop of lambs was marketed at an average age of 184 days. They averaged 79 lb. and returned an averaged dressed weight of 36.9 lb. The live grade was 2 or good and the dressed grade 2+ or high good.

Table 3—Record of Growth, Marketing Data, and Autopsy Findings of Lambs in 1944

Lamb number	Birth wt. (lb.)	Age weaned and placed in feed lot	Wt. when weaned (lb.)	Days in feed lot	Age marketed	Weight marketed (lb.)	Live grade	Dressed weight (lb.)	Dressed grade	Ova per gram of feces: At 6 weeks of age	Ova per gram of feces: At time of slaughter	Name and number of parasites found at autopsy: H. Contortus (Twisted stomach worm)	Trichuris Sp. (Whip worm)	Cooperia Sp. (No common name)	Ostertagia Sp. (Medium stomach worm)	Cestoda (Common tapeworm)
581	9	179	60	49	228	74	3	34.75	3	0	1900	45	25	50	----	----
582	10	178	80	21	199	93	2+	43.50	1—	0	0	----	----	----	----	----
583	8	178	66	49	227	81	2—	39.00	2	0	0	----	----	----	----	----
584	8	176	60	35	211	80	2—	36.50	2	0	400	4	----	----	----	----
585	6	176	71	21	197	82	2+	36.00	2	0	0	----	----	----	----	----
586	9	170	73	21	191	83	2—	36.50	2—	0	0	----	----	----	----	----
587	8	170	78	21	191	87	2	39.00	2—	0	0	----	----	----	----	----
588	10	170	63	49	219	79	3+	39.00	2	0	0	----	----	----	----	----
590	9	168	76	21	189	84	2	39.50	2	0	800	----	----	----	25	----
591	7	167	60	49	216	76	2	38.50	2+	0	0	----	----	----	----	----
592	7	167	66	35	202	83	2+	41.00	1—	0	0	----	----	----	----	----
594	8	164	65	35	199	80	2	37.00	2—	0	0	----	----	----	----	----
595	8	163	62	35	198	85	2—	39.00	2—	0	500	8	----	----	----	----
412	9	160	51	49	209	60	2—	30.75	2	0	200	----	----	----	----	----
413	7	160	65	35	195	83	2—	40.00	2	0	0	----	----	----	----	----
414	7	159	67	35	194	87	2+	39.50	1—	0	0	----	----	----	----	----
415	10	154	65	49	203	75	3	35.50	3—	0	0	----	----	----	----	----
416	8	154	63	35	189	83	2—	35.50	3—	0	0	----	----	----	----	----
418	8	153	54	49	202	63	3	27.75	2+	1200	700	----	----	47	----	----
420	10	148	74	21	169	80	2	37.50	2+	0	400	----	----	----	15	10
421	7	144	52	49	193	70	2—	33.50	2—	0	0	----	----	----	----	----
422	9	136	67	21	151	80	2+	37.50	2+	0	600	12	----	----	----	----
423	6	135	51	49	184	64	3—	30.50	3—	200	100	----	----	----	----	----
424	6	135	50	49	184	66	3—	30.50	3—	0	0	----	----	----	----	----
Av.	8	163+	64	36.6	198+	78	2—	36.5	2—			----	----	----	----	----

Table 4—Record of Growth, Marketing Data, and Autopsy Findings of Lambs in 1945

Lamb number	Birth wt. (lb.)	Age weaned and placed in feed lot	Wt. when weaned (lb.)	Days in feed lot	Age marketed	Weight marketed (lb.)	Live grade	Dressed weight (lb.)	Dressed grade	Ova per gram of feces: At 6 weeks of age	Ova per gram of feces: At time of slaughter	Name and number of parasites found at autopsy: H. Contortus (Twisted stomach worm)	Trichuris Sp. (Whip worm)	Cooperia Sp. (No common name)	Ostertagia Sp. (Medium stomach worm)	Cestoda (Common tapeworm)
425	10	----	----	0	165	81	2	33.0	2—	0	0	----	----	----	----	----
903	10	----	----	0	160	76	2	33.0	2+	400	200	10	----	----	----	3
904	10	----	----	0	159	86	2—	33.75	1	200	0	----	----	----	----	----
905	9	----	----	0	157	87	1—	41.50	1	200	0	----	----	----	----	----
906	10	----	----	0	155	88	2+	39.50	2+	0	100	----	10	----	----	----
909	9	----	----	0	153	77	2	35.25	1—	0	0	----	----	----	----	----
910	10	----	----	0	153	82	2	36.00	2+	0	0	----	----	----	----	----
913	6	166	73	55	221	78	2—	36.50	2—	600	3500	340	----	----	----	----
914	6	166	54	55	221	71	2—	30.50	3	200	2500	179	20	----	----	----
915	7	165	72	55	220	72	3	32.25	2	0	5000	726	2	----	----	----
916	8	165	73	55	220	82	2	38.75	2	0	0	----	----	----	----	----
918	8	160	66	55	215	78	2	38.55	2	0	7000	830	----	----	----	----
919	7	160	68	55	215	73	2—	33.25	3	0	1700	450	4	----	----	----
920	9	----	----	0	146	84	1	40.00	1	500	300	6	25	----	----	----
921	10	----	----	0	146	87	1	44.50	1—	400	0	----	----	----	----	----
922	9	159	65	55	204	75	2	37.00	2	0	0	----	----	----	----	----
923	8	156	73	55	201	87	2+	44.50	1	0	200	25	----	----	----	----
924	7	156	53	55	201	64	2—	36.00	2+	0	200	4	12	----	----	----
Av.	8.5	157	66	55	184	79.3	2	36.9	2+	----	----	----	----	----	----	----

The ova count was considerably higher in this crop of lambs than in the 1944 crop. Parasites were recovered from 12 of the lambs at the time of slaughter. The number of parasites was high, but with good feed, no appreciable damage in growth and development was apparent.

Table 5 shows the record of the growth, market data, ova count, and autopsy findings of the 1946 crop of 12 lambs that had access to a 14:1 mixture of salt and phenothiazine. This group averaged 9.2 lb. at birth; 5 of them were placed in the feed lot at 154 days of age, averaging 72 lb. On the day the 5 lambs were so placed, the other 7 lambs were marketed. This entire crop of lambs when marketed averaged 167 days in age and 82 lb. in weight. They returned a dressed-carcass weight of 40.39 lb. The live and dressed grades each averaged 1—, or low choice.

Parasites were recovered from all 12 of these lambs at the time of slaughter in rather large numbers. No symptoms of parasitism were shown by any of the lambs in this group.

Table 6 shows the record of growth, market data, ova count, and autopsy findings of the 1947 crop of 22 lambs that had access to a 14:1 salt-phenothiazine mixture. This group of lambs averaged 8.3 lb. at birth; 12 of the lambs when placed in feed lot at 155 days of age averaged 65.6 lb. On the day the 12 lambs were placed in the feed lot, the other 10 were marketed. This entire crop of lambs when marketed averaged 180 days in age and 78 lb. in weight and returned an average dressed carcass weight of 39.3 lb. The average live and dressed grades each was 2+ or high good.

Parasites were recovered from 10 of the lambs of this crop at time of slaughter. The number of parasites was relatively low and caused no appreciable symptoms in the live animals.

Table 6 shows the record of the ova per gram of feces for the four annual crops of lambs in this experiment.

The first count was made at an average age of about six weeks; for each year the ova were consistently lower at this time. The second count was made in midsummer; the ova count at this time was higher than at the average age of six weeks.

The third count was made at time of slaughter. In 1944 the autopsy count was lower than the midsummer count but in 1945 and 1946 the autopsy count was higher than the midsummer count. In 1947 only two counts were made, that at 6 weeks and the midsummer count, which coincided with slaughter, hence was also the post-mortem count. This group was of proper weight and was sent to slaughter.

The high count at time of slaughter in 1945 was probably due to the circumstance that the 19:1 salt-phenothiazine mixture was too low in phenothiazine. The dams also showed a high ova count at end of the year.

The 1946 lamb crop was high in ova and parasites at time of slaughter. Dogs killed or severely injured, so that they had to be destroyed, all but 12 of the crop. The killing was done in and about the

Table 5—Record of Growth, Marketing Data, and Autopsy Findings of Lambs in 1946

Lamb number	Birth wt. (lb.)	Age weaned and placed in feed lot	Wt. when weaned (lb.)	Days in feed lot	Age marketed	Weight marketed (lb.)	Live grade	Dressed weight (lb.)	Dressed grade	Ova per gram of feces: At 6 weeks of age	Ova per gram of feces: At time of slaughter	Name and number of parasites found at autopsy: H. Contortus (Twisted stomach worm)	Trichuris Sp. (Whip worm)	Cooperia Sp. (No common name)	Ostertagia Sp. (Medium stomach worm)	Cestoda (Common tapeworm)
933	10	----	----	0	161	83	2+	40.01	1	0	200	15	----	----	----	12
934	9	157	68	38	195	75	2+	37.00	2+	0	3000	260	2	----	----	2
936	8	157	73	31	188	75	2+	38.00	2+	0	4000	250	6	----	----	----
938	7	155	68	38	193	75	1—	37.00	1	500	2000	225	7	----	----	----
939	10	----	----	0	152	81	2+	36.50	2	0	1200	200	----	----	----	8
940	7	152	76	38	190	90	1	42.50	1+	0	1200	100	----	----	----	----
942	9	151	75	31	182	77	1—	37.00	1	0	2200	200	2	----	----	----
944	11	----	----	0	151	96	1	47.75	1	0	1000	200	1	----	----	12
945	8	----	----	0	150	78	1	40.00	1	400	2300	500	----	----	----	----
946	10	----	----	0	150	83	1—	43.00	1—	0	1600	400	----	----	----	----
948	11	----	----	0	148	92	2	44.00	2	0	2600	500	----	----	----	10
949	11	----	----	0	148	77	2	42.00	2+	0	2100	400	----	----	----	----
Av.	9.2	154	72	35	167	82	1—	40.39	1—	Av.	Av.	----	----	----	----	----

Table 6—Record of Growth, Marketing Data, and Autospy Findings of Lambs in 1947

Lamb number	Birth wt. (lb.)	Age weaned and placed in feed lot	Wt. when weaned (lb.)	Days in feed lot	Age marketed	Weight marketed (lb.)	Live grade	Dressed weight (lb.)	Dressed grade	Ova per gram of feces: At 6 weeks of age	Ova per gram of feces: At time of slaughter	Name and number of parasites found at autopsy: H. Contortus (Twisted stomach worm)	Trichuris Sp. (Whip worm)	Cooperia Sp. (No common name)	Ostertagia Sp. (Medium stomach worm)	Cestoda (Common tapeworm)
961	7	164	65	78	242	84	1	43.0	1	0	0	----	----	----	----	----
962	8	164	65	34	199	78	2	35.5	2—	0	200	25	----	----	----	----
963	10	----	----	0	161	72	2—	36.0	2—	0	200	20	----	----	----	----
964	7	158	57	78	236	78	1	37.0	1	0	0	----	----	----	----	----
965	6	158	53	78	236	65	1	33.0	1	0	600	54	----	----	----	----
966	8	----	----	0	157	72	2+	39.0	2+	100	400	30	----	----	----	----
967	7	156	65	35	191	75	2—	37.5	2+	300	700	50	----	----	----	----
968	7	156	57	78	234	77	1	41.0	1	0	0	----	----	----	----	----
969	9	155	70	35	190—	80	1—	41.5	1—	0	0	----	----	----	----	----
970	9	155	71	35	190	80	2—	37.5	2+	0	0	----	----	----	----	----
971	8	155	71	35	190	81	2+	38.5	2+	0	0	----	----	----	----	----
972	8	----	----	0	155	77	2+	40.0	1—	200	0	----	----	----	----	----
973	11	153	78	35	188	94	2	45.0	1—	200	0	----	----	----	----	----
974	10—	----	----	0	152	74	2+	40.0	1—	0	0	----	----	----	----	----
978	6	----	----	0	149	73	3+	36.0	2	400	200	15	----	----	----	----
980	11	----	----	0	146	84	1—	43.0	1	0	100	10	----	----	----	----
981	7	145	73	35	180	84	2+	40.5	2+	0	0	----	----	----	----	----
982	9	144	63	78	222	85	2	45.0	2	0	0	2	2	----	----	----
984	10	----	----	0	143	73	2+	37.0	1—	0	0	----	----	----	----	----
985	9	----	----	0	143	72	2	36.0	2	0	0	----	----	----	----	----
986	11	----	----	0	139	85	1	45.0	1	0	200	12	----	----	----	----
987	11	----	----	0	131	78	2—	38.0	2	0	300	27	----	----	----	----
Av.	8.3	155	65.6	52.8	180.6	78	2+	39.3	2+	----	----	----	----	----	----	----

shed where the salt-phenothiazine box was located. As a result the 1946 lambs may have consumed less phenothiazine and salt.

In addition to the grade ewes and their market lambs in the experimental flock, the University's registered purebred flock of approximately 75 head of ewes and their lambs have had access to a 14:1 salt-phenothiazine mixture for more than 3½ yr. Random samples of feces have been examined with no ova or only a very light ova count. This flock of ewes and lambs shows evidence that the 14:1 salt-phenothiazine mixture fed *ad libitum* has given better results than any control method previously used on it for the control of gastro-intestinal parasites.

SUMMARY AND CONCLUSIONS

Grade ewes and their offspring were allowed continuous access to a salt-phenothiazine mixture for the control of gastro-intestinal parasites. The mass feeding covered a period of 4 yr. During this time no treatment other than access to the salt-phenothiazine mixture was given, and no salt supply was provided other than the salt in the mixture.

The total number of individual ewes used was 39 and the total number of lambs marketed, 76. This is a low market percentage of lambs to ewes bred. However, during 3 of the 4 yr., sheep-killing dogs did some damage to the flock. The 1946 crop of lambs suffered the greatest damage.

No ill effects were noted from consumption of the salt-phenothiazine mixture, either from a general health or a breeding efficiency viewpoint.

The ewes consumed an average of six-tenths of a pound of the mixture per ewe per month, which averages about 18 grams of phenothiazine per ewe per month.

The lambs consumed little or none of the mixture until the last 1½ to 2 mos. before weaning and placing in feed lot.

The 19:1 salt-phenothiazine mixture was not adequate in the control of gastro-intestinal parasites in either the ewes or the lambs.

The 14:1 salt-phenothiazine mixture under the conditions of feed and management used in the experiment were found to give control of the gastro-intestinal parasites in this breeding flock and in their market lambs. (The conditions of this experiment are not materially different from the conditions found in much of West Virginia's better sheep-raising districts.)

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